

transistors between the respective drain terminal and the source terminal, considerable nonlinear signal distortions occur in conventional echo cancellation filters and impair the echo signal cancellation.

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The object of the present invention, therefore, is to provide a programmable echo cancellation filter which has minimal nonlinear signal distortions.

10 This object is achieved according to the invention by means of a programmable echo cancellation filter having the features specified in patent claim 1.

15 The invention provides a programmable echo cancellation filter for echo signal cancellation for a transceiver having

a signal input for receiving the transmission signal emitted by the transceiver,

an input resistor connected to the signal input,

20 an operational amplifier, whose signal input is connected to the input resistor and whose signal output is connected to an output resistor,

a first programmable resistor circuit, which is provided between the signal output of the operational amplifier and the signal input of the operational amplifier,

25 a second programmable resistor circuit, which is provided between the output resistor and a signal output of the echo cancellation filter,

30 a third programmable resistor circuit, which is provided between the first programmable resistor circuit and the signal output of the echo cancellation filter,

35 the programmable resistor circuits each having a plurality of resistors which are terminated in parallel and are connected to a first terminal of an associated controllable switch,

the controllable switches having a second terminal connected to a virtual reference voltage terminal with a negligible voltage swing.

- 5 Thus, according to the invention, the controllable switches are connected by their second terminal to a reference voltage terminal with a very low voltage swing, with the result that the nonlinear signal distortions at the controllable switches are minimal.

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In this case, the virtual reference voltage terminal is an input terminal of an operational amplifier which forms a virtual ground.

- 15 In this programmable echo cancellation filter according to the invention, the controllable switches of a programmable resistor circuit preferably each have a control terminal which is connected via a control line to a control circuit for setting the resistance of the
20 resistor circuit.

The control circuit is preferably a DSP processor.

- The controllable switches are preferably MOSFET
25 transistors whose controllable gate terminals are driven by the control circuit.

- The programmable echo cancellation filter according to the invention preferably has a capacitor which is
30 connected to a relatively low-impedance line node of the echo cancellation filter.

- The programmable echo cancellation filter according to the invention has the advantage that it requires only
35 one capacitor for generating the required filter transfer function.

The controllable switches of the first programmable resistor circuit are preferably connected to the signal input of the operational amplifier as virtual reference potential terminals.

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The controllable switches of the second programmable resistor circuit and the controllable switches of the third programmable resistor circuit are preferably connected to the signal input of an operational amplifier of an automatic gain control circuit of the transceiver.

The echo cancellation filter according to the invention is preferably supplied with a low supply voltage.

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In a particularly preferred embodiment, the echo cancellation filter according to the invention is of fully differential construction.

In a preferred embodiment, the echo cancellation filter according to the invention is constructed as a first order analog low-pass filter.

The signal input of the echo cancellation filter according to the invention is preferably connected to a signal matching circuit for signal matching of the transmission signal.

The signal output of the echo cancellation filter according to the invention is preferably connected to the signal input of an automatic gain control circuit in a reception signal path of the transceiver.

The resistors contained in the programmable resistor circuits preferably have mutually weighted resistances.

In a preferred embodiment of the echo cancellation filter according to the invention, the gain of the echo